# Report Documentation Page

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**Approved for public release; distribution unlimited**

13. SUPPLEMENTARY NOTES

14. ABSTRACT

**Dresser-Rand Corporation located in Wellsville, NY, is responsible for power generation for the new CVN-21 Carrier for the U.S.NAVY. Development of newer power generation systems has lead to the use of advanced materials with characteristics that allow the turbine blade (bucket) to withstand increased condensation levels. The new material characteristics, with higher than normal Rockwell hardness, created many manufacturing challenges. Shorter tool life, longer processing times and longer hand finishing perations all contributed to extended lead times and additional cost. Faced with these challenges, Dresser-Rand requested the help of the National Center for Defense Manufacturing & Machining (NCDMM) to review and provide solutions that would reduce their cost and turn around times.**

15. SUBJECT TERMS
**NCDMM; Success Stories; CVN-21 Carrier Power Generation / Turbine Blade; Kennametal Inc.; AMRDEC; Dresser-Rand Corporation**

| 16. SECURITY CLASSIFICATION OF: | | | 17. LIMITATION OF ABSTRACT | 18. NUMBER OF PAGES | 19a. NAME OF RESPONSIBLE PERSON |
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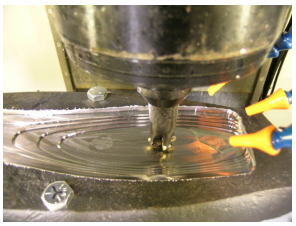
# CVN-21 Carrier
# Power Generation / Turbine Blade

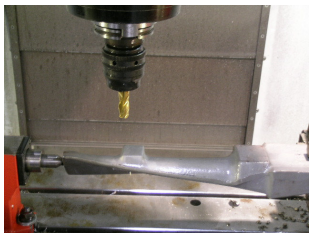
**NCDMM Project No. 04-0053-12**

Technical Report

## PROBLEM / OBJECTIVE

Dresser-Rand Corporation located in Wellsville, NY, is responsible for power generation for the new CVN-21 Carrier for the U.S.NAVY. Development of newer power generation systems has lead to the use of advanced materials with characteristics that allow the turbine blade (bucket) to withstand increased condensation levels. The new material characteristics, with higher than normal Rockwell hardness, created many manufacturing challenges. Shorter tool life, longer processing times and longer hand finishing operations all contributed to extended lead times and additional cost. Faced with these challenges, Dresser-Rand requested the help of the National Center for Defense Manufacturing & Machining (NCDMM) to review and provide solutions that would reduce their cost and turn around times.





Advanced programming and cutting techniques are being tested (left). "Proof-of-concept" part (right) that NCDMM created to demonstrate new tooling and manufacturing processes to Dresser-Rand

## ACCOMPLISHMENTS / PAYOFF

***Process Improvement***

NCDMM engineers conducted testing on the new material with state-of-the-market tooling to establish optimal cutting parameters. Advanced programming techniques were developed to allow the tooling to perform to their optimum potential and within the existing machine parameters. These programming techniques utilized the ball nosed style tooling with optimized approach angles that permit the tool to cut the material effectively, thus reducing smearing to the material and less generation of heat going into the workpiece.

***Implementation and Technology Transfer***

New advanced machining techniques and cutting parameters reduced existing operation time on the larger of two size buckets from 5.5 hours to 2.5 hours per bucket. The finish produced from these new techniques is significantly better, reducing hand-finishing time from 2 hours to an estimated .75 hour per bucket. These new processes, when applied to the smaller buckets (original material), will achieve a 10-15% reduction in manufacturing cost.

The following are the advanced manufacturing techniques that have been implemented or are in the process of being implemented:

- Advanced contour programming techniques implemented
- Optimum cutting parameters implemented
- Increased metal removal rate (MRR) by 200%
- Reduced tool usage by 30%
- Improved surface finish by approx. 50%
- Reduction in hand finishing time by >75%

***Expected Benefits***

With the implementation of these advanced manufacturing techniques, the new process will significantly improve the machine time per bucket. With an average 2000 buckets (both large and small sizes), per turbine based on an average machine shop cost of $100/hour, this equates to savings of $470K per turbine. This will equate to $2.5M over a five-year period.

Additional savings will be recognized with the implementation of the advanced programming techniques. These techniques provide longer tool life thus reducing tool usage.

## TIME LINE / MILESTONE

Start Date.....November 05
End Date.....February 05

## PROJECT FUNDING

NCDMM / Dresser-Rand (Cost Share)… .....<$30K

## PARTICIPANTS

HAAS
Com1 Information Technologies, Inc.
Kennametal Inc.

*For additional information concerning this project, contact the NCDMM at www.ncdmm.org*